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Superhumps linked to X-ray emission: The superoutbursts of SSS J122221.7-311525 and GW Lib

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Abstract

© 2018 ESO. Context. We present more than 4 years of Swift X-ray observations of the 2013 superoutburst, subsequent decline and quiescence of the WZ Sge-type dwarf nova SSS J122221.7-311525 (SSS J122222) from 6 days after discovery. Aims. Only a handful of WZ Sge-type dwarf novae have been observed in X-rays, and until recently GW Lib was the only binary of this type with complete coverage of an X-ray light curve throughout a superoutburst. We collected extensive X-ray data of a second such system to understand the extent to which the unexpected properties of GW Lib are common to the WZ Sge class. Methods. We collected 60 Swift-XRT observations of SSS J122222 between 2013 January 6 and 2013 July 1. Four follow-up observations were performed in 2014, 2015, 2016 and 2017. The total exposure time of our observations is 86.6 ks. We analysed the X-ray light curve and compared it with the behaviour of superhumps which were detected in the optical light curve. We also performed spectral analysis of the data. The results were compared with the properties of GW Lib, for which new X-ray observations were also obtained. Results. SSS J122222 was variable and around five times brighter in 0.3-10 keV X-rays during the superoutburst than in quiescence, mainly because of a significant strengthening of a high-energy component of the X-ray spectrum. The post-outburst decline of the X-ray flux lasted at least 500 d. The data show no evidence of the expected optically thick boundary layer in the system during the outburst. SSS J122222 also exhibited a sudden X-ray flux change in the middle of the superoutburst, which occurred exactly at the time of the superhump stage transition. A similar X-ray behaviour was also detected in GW Lib. Conclusions. We show that the X-ray flux exhibits changes at the times of changes in the superhump behaviour of both SSS J122222 and GW Lib. This result demonstrates a relationship between the outer disc and the white dwarf boundary layer for the first time, and suggests that models for accretion discs in high mass ratio accreting binaries are currently incomplete. The very long decline to X-ray quiescence is also in strong contrast to the expectation of low viscosity in the disc after outburst.

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Keywords

Accretion, accretion disks, Methods: observational, Novae, cataclysmic variables, Stars: dwarf novae, Stars: individual: GW Lib, Stars: individual: SSS J122221.7-311525

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